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FLAX

$ $ A Good Cash Crop! $ $

Foreword

FLAX is a profitable crop. It will bring the highest returns to the flax growers, who follow good, sound cultural practices.

Unfortunately, too many farmers consider flax as a salvage and cleaning-up crop, which can be sown at the last minute, when it is too late for other crops, and in any kind of soil, weedy and unfit for other grains. It is not surprising to find such careless farmers disappointed in the poor yield and low returns of their flax crop. No crop is profitable unless properly planned.

In the following pages, Dr. P. J. Olson, Professor of Plant Science, at the University of Manitoba, has outlined some good, sound cultural practices, which, if closely followed, will pay large dividends in increased yield of flax seed per acre. He has pointed out some of the pitfalls and difficulties, which may beset the flax grower, and has indicated how they may be effectively avoided and overcome.

It is to help flax growers in securing better yields and greater returns from their flax crops that this booklet is published through the courtesy of the Winnipeg Flax Fibre Division of Howard Smith Paper Mills, Limited, in co-operation with the Canadian Flax Institute.

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Some things you should know about FLAX

by Dr. P. J. OLSON

Professor of Plant Science, University of Manitoba

FLAX is a dependable crop. The average farmer on good land, who applies good cultural practices, may, in most years, look forward to a somewhat greater return from flax than from wheat. The crop is not beset with as many hazards as was once the case. The development of improved disease resistant varieties and effective methods of weed control have contributed in large measure to the reduction of those hazards.

The immediate prospect of attractive returns for flax appears good. The recent Dominion-Provincial Conference, in analyzing the domestic requirements indicated that the goal for 1952 should again be one million acres. The indications are that there will be good export demand. The stocks on hand both in Canada and the United States are well below those of recent years. Those in the United States are estimated to be ten million bushels short of their requirements. The government of that country recently raised the flax support price by a little more than one dollar per bushel, and the Secretary of Agriculture is asking farmers to increase their production over that of 1951 by about 12%. The Argentine, which has long been an outstanding competitor in the export market has disposed of its surpluses and its current crop is the lowest in many years. It does not appear likely that any surplus that Canada may produce in 1952 will go begging.

Factors basic to good Flax production

The following are the more important factors and cultural and management practices that will provide maximum opportunity for obtaining high yields and top quality.

1. Productive land.
2. The right variety.
3. Good seed.
4. A good seed bed.
5. Timely sowing.
6. Weed control.
7. Proper harvesting.

Productive land

Any land that will produce good crops of wheat, oats or barley is capable of producing good crops of flax. But since it may be expected to yield higher net returns, and since growers will usually produce substantially lower acreages of flax than of those other crops,

Good cultural practices will bring a good flax crop.

they will be well advised to select their very best land for flax. The cleanest land available should be chosen, since flax is much less able to compete with weeds than wheat, oats or barley. Moreover, it has a somewhat less vigorous and less extensive root system, and therefore is not as efficient in making use of the plant food material and moisture that is available per unit area.

Land that grew an intertilled crop such as corn, sugar beets or potatoes will usually produce good crops of flax. Such land usually requires no spring tillage beyond such harrowing or cultivating as may be necessary to work down the ridges left by the intertillage. If sufficient cultivation was given to produce a clean intertilled crop, the weed problem in flax will usually be at a minimum, and the cost of producing the crop will also be at a minimum. Summer-fallow is usually the most productive land on the farm, because it affords maximum moisture conservation. The weed control that it achieves, when cereal crops are grown the following year, is not so effective when flax is grown upon it. This is so because, as summer-fallow is ordinarily worked, many weed seeds such as mustard, stinkweed, and lamb's quarters lie dormant and germinate the following year. Flax being a poor weed competitor does not outgrow these weeds as wheat, oats or barley do, and flax on summer-fallow, therefore, frequently is weedy. Such weeds may be reduced to a minimum by earlier and more frequent working of the summer-fallow. Even though it is found that the following flax crop is weedy, that is no longer a serious matter, because most

such weeds may be readily controlled by early application of 2,4-D. (Wild oats, green foxtail and wild buckwheat are exceptions.)

Flax will usually do very well following sweet clover or alfalfa. Wherever it is planned to follow sweet clover with flax, the sweet clover should preferably not be allowed to go to seed. Best results are obtained when the sweet clover is plowed under early, and the land kept fallow for the rest of the season. This is so for two reasons. The first is that sweet clover, if allowed to grow rankly until late in the season removes large amounts of moisture from the soil and, unless fall or early spring rains are abundant, the flax crop may suffer from drought. The second is that, if the sweet clover is allowed to go to seed, it may volunteer in the succeeding flax crop to such an extent as to seriously reduce yields and make it difficult to harvest the crop. This, however, can be largely offset by treatment with 2,4-D. Sweet clover is very susceptible to this chemical and can be controlled if it appears soon enough, so that the 2,4-D may be applied when the flax crop is young.

Where flax is to follow alfalfa, the land should be plowed as soon as the hay crop has been removed, and any regrowth should be destroyed by appropriate cultivation.

Flax usually does well on grass sod. The grass should be broken in the late summer or fall. If the sod is well turned so that the resulting surface is smooth, it may not require any further working before the flax is sown. If the breaking is too rough, packing or light disking or both will be required. This may be done in the fall or spring or both as the situation may demand. It is important to have the surface as smooth as possible, if a good stand is to be obtained because flax must be sown shallow. If regrowth of the grass takes place, it can usually be controlled by light disking. Disking should ordinarily be shallow enough so as not to cut through the furrow slice. Disking must be followed by packing.

The use of stubble land for flax is coming to be a more and more common practice. While greater yields may be expected from any of the other types of land just described, good results are often obtained where the crop is grown on stubble land only one year removed from summer-fallow or other specially prepared or favourably treated land, if weeds are controlled. Here again, the advent of 2,4-D and other weed control chemicals has reduced the hazards attending flax production. Where stubble land is to be used, it should be given the same kind of treatment as if wheat were to be grown on it. On soils of medium and heavy texture in the areas where the moisture situation is favourable it should be plowed in the fall; the earlier the better. On lighter land and in drier areas, where wind erosion is a serious hazard, it is common practice to plow the land in the spring rather than in the fall. Dr. J. B. Harrington, Professor of Field Husbandry, University of Saskatchewan, in his bulletin "The Growing of Flax" makes these recommendations regarding the preparation of stubble land for flax in Saskatchewan.

> "Stubble land should be disked lightly in the fall soon after harvest, unless there is considerable danger of this resulting in soil drifting. The

fall disking will start many weeds if there are early fall rains. The stubble holds the snow and prevents drifting of the soil in early spring. If the soil contains many weed seeds, particularly Russian thistles or wild oats, it may be advisable to delay seeding until one or two crops of weeds are eradicated. Where no fall cultivation has been done the land can be lightly disked early in the spring to cover the surface weed seeds and encourage germination. After spring disking, it usually takes two weeks for a crop of weeds to make a good start, consequently the seeding of flax may be delayed until about the third week."

Flax should not follow flax, and should not be sown on land immediately adjacent to flax stubble. This is important because of the danger of introducing disease that may have been carried by the preceding crop.

Flax wilt—this disease will attack flax at any stage. Avoid it by growing wilt-resistant varieties.

The right variety

The choice of variety is of primary importance. Disease is one of the most serious limiting factors in flax production. Wilt and rust are the two greatest disease enemies of the crop. Both may be avoided by growing resistant varieties. Plant breeders have produced varieties that are immune or highly resistant to both of these diseases. These varieties are equal or superior in yielding capacity to older varieties that are susceptible. They include the following which are well adapted to the Prairie Provinces: Rocket, Victory, Sheyenne and Redwood. Of these, Sheyenne and Redwood are immune to all forms of rust now known on the North American continent. They do not show even a trace of rust. Rocket has never been completely purified and has a small percentage of plants that show some rust. The amount is not sufficient to be of any practical significance. Victory, likewise, consists of an admixture of types and usually shows some rust; somewhat more than Rocket. However, in this case, also, the amount has never been great enough to make it a serious limiting factor in yield of the crop. Redwood is the newest of these varieties; so new that it will be at least two years before there is sufficient seed to meet the demand.

Other varieties that are still widely grown are Royal, Dakota and Redwing.

Dakota and Redwing are highly resistant to wilt; Royal sufficiently so that wilt has not been an important factor in the Prairie Provinces, when this variety has been grown. All of these varieties are susceptible to rust; Royal somewhat less than the other two. Dakota is extremely susceptible; so much so that, in spite of its merit where rust does not prevail, it is likely to be practically abandoned as Bison was some ten years ago. Dakota is not recommended in Manitoba.

There is a great difference in earliness between these varieties. Rocket, Royal, Redwood and Victory are late. They are well adapted to the southerly areas, where they are capable of producing much higher yields than the early varieties. Sheyenne and Redwing are early and well adapted to the northerly areas, or for late seeding in the southerly areas. Dakota is intermediate and, except where rust has been a serious factor, has been popular in all areas. Its yielding capacity, under non-rust conditions, is superior to that of Sheyenne or Redwing.

If they can obtain seed, farmers are strongly urged to sow only the rust and wilt resistant varieties.

In addition to rust and wilt, another disease, Pasmo, is of common occurrence in flax. As yet no varieties are known that are highly resistant to this disease. Fortunately it ordinarily does much less damage than either rust or wilt. It attacks flax late enough in the season so that serious harm is usually avoided.

Good Seed

Only clean sound seed and seed that is true to the variety should be sown. If the grower finds that he can not remove all of the weed seeds with his own equipment, he should take it to a reputable commercial cleaner. The seed should be tested for germination, if there is any doubt as to its soundness. This is important at any time, but especially so in the case of many of the present stocks of seed, which may contain an excess of moisture owing to unfavourable harvesting and threshing conditions. The local agricultural representative will be able to advise as to how or where such testing may be done. Such seed may have been damaged by heating or freezing. If he is not satisfied that the quality of his seed is satisfactory, the grower will be well advised to buy certified or registered seed. Such seed carries its own guarantee as to both purity and soundness.

Seed should be treated with an organic mercury compound. Most samples of flax exhibit more or less cracking of the seed coat. These cracks admit organisms that are present in the soil with the result that the seed is destroyed before or soon after germination. This situation is responsible for the fact that many samples of seed that show good germination in the laboratory, often show poor germination when sown. Treatment will protect the seed from such soil-borne organisms. Since samples that appear normal may actually have minute cracks that are scarcely visible to the naked eye, the practise of treating before sowing should always be followed. Treatment should be applied within one month of sowing in the case of seed with normal moisture content. Seed known to

contain excess moisture should be treated within 24 hours of sowing. Ceresan M, Leytosan, Agrox C, Mergama C or Panogen may be used. The rate in each case is 1½ oz. per bushel. (Directions will be found on manufacturer's label.)

A good seed bed

Compactness is the most important feature to be achieved in preparing a seed bed for flax. It is important because flax must not be sown deep; not more than 1 to 1½ inches. Since the seed is small, compactness is necessary so that as much soil as possible may be in contact with the seed in order to promote rapid and uniform germination. Much of this packing may be done with the drag harrow. This implement packs the subsurface, which is an important objective. For the final packing the cultipacker is an excellent tool. It is much better than the ordinary roller or "Pulverizer" since the latter tends to pack only the immediate surface and to promote soil blowing. It is a good plan to use this implement both before and after seeding. If a cultipacker is not available, a disk run straight so as to prevent cutting and turning the soil and loaded, as may be required, is effective. The use of a press drill, where the soil is dry enough so that it will not be picked up by the press wheels will further enhance packing and prevent burying the seed too deeply.

Timely sowing

Flax should be sown early. Many growers make the mistake of sowing late, believing that the crop is likely to be destroyed by frost, if sown early. As a matter of fact flax is not highly sensitive to frost in the early seedling stages, except the seed leaf stage. It has been demonstrated that it will endure temperatures as low as 18 or 20 degrees for the short periods that such low readings are likely to prevail. In general it will be quite safe to sow flax ten days after the normal date for sowing wheat in any season. If the land is clean so that there is no need for spring tillage in order to destroy weeds, it is virtually certain that delayed sowing will result in reduced yields. This fact is well demonstrated by the following data:

Seedling blight—a loose seed bed contributed toward this result.

Yield of flax under different dates of sowing at Winnipeg *

VARIETY	DATE OF SOWING 1948		
	May 12	May 21	May 29
Rocket	32.01	24.74	10.24
Dakota	30.40	29.42	14.92
Sheyenne	25.26	25.62	16.58

	1949			
	May 2†	May 12	May 21	June 2
Rocket	19.28	19.75	19.38	11.54
Victory	19.23	18.81	20.27	13.77
Dakota	20.37	19.90	19.59	14.55
Sheyenne	13.25	15.64	16.79	12.16

†*Injured by frost May 24, 1949.*

	1951			
	May 9	May 21	June 1	June 12
Rocket	22.5	18.1	15.5	7.3
Victory	24.8	22.2	16.0	9.6
Dakota	16.5	16.8	16.7	11.1
Sheyenne	17.7	18.2	16.3	15.5

**Unpublished data of Dr. W. E. Sackston, Dominion Laboratory of Plant Pathology, Wpg.*

It is clear from the above data, that yields were sharply reduced by delayed sowing expecially in the case of the late varieties. While the range in period of time during which sowing could be done with satisfactory results varied from season to season, as one would expect, in practically all cases delay beyond May resulted in reduced yields. The advisability of choosing an early variety such as Sheyenne when late sowing is

Delayed sowing may do this. Plot in background sown May 12; plot in foreground sown May 29. Photo taken July 9.

necessary, for any reason, is also shown clearly. That variety did not suffer nearly as much as either Rocket or Victory, which are late.

When flax is sown on stubble land, on poorly worked summer-fallow, or on land that for any reason is likely to be weedy, it is advisable to delay sowing long enough to permit the elimination of the first crop of weeds by tillage. This is especially true if wild oats is a major weed, since this cannot be controlled by subsequent treatment with 2,4-D. This will usually mean sowing in late May or early June. An early variety such as Sheyenne, should be used in these circumstances, in order to insure that the crop will be fully mature in advance of fall frosts. Packing becomes especially important where the soil has been loosened by this type of early spring treatment.

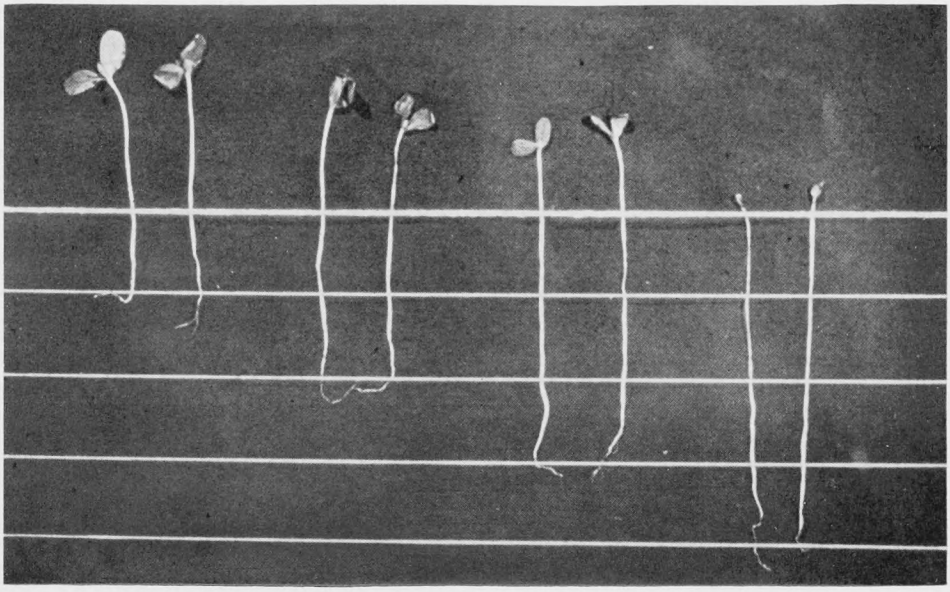
The use of the one way disk with attached seeder (tiller combine) has become common practice in recent years where the crop is sown on stubble land. Care must be taken not to sow the seed too deeply, and the land should be well packed immediately after sowing.

The standard sowing rate for flax is 28 pounds per acre. Some variation in rate is justified on the basis of percentage germination, size of seed and moisture conditions. For smaller seeded varieties, such as Sheyenne or Redwing, 28 pounds is ample under all conditions. For larger seeded varieties, such as Victory or Rocket, in areas of higher rainfall on highly productive soils, rates up to 35 or even 40 pounds are preferable. In areas of lower rainfall and on lighter land, 20 pounds of the smaller seeded varieties is ample.

Weed Control

Something has already been said about cultural methods for controlling weeds. At best it is possible to achieve

Avoid sowing flax too deep. Shallowest sowing 1 inch; deepest sowing 4 inches.



only partial control by such methods. Chemical control, therefore, can be a great ally of the flax grower. The chemical, 2,4-D, will control effectively all of the weeds commonly found in flax, except wild oats, green foxtail and wild buckwheat. When judiciously applied, it will do little or no harm to the flax crop. The secret of success lies in applying the chemical at the right time and in the minimum doses required to destroy the weeds. Fortunately, such weeds as common mustard, stinkweed, lamb's quarters and rough or red-root pigweed are highly susceptible. They may be controlled with rates as low as 2 ounces acid equivalent per acre. If the following precautions are taken excellent results may be expected:

1. Apply the chemical before the flax has reached the bud stage. After the flax has formed true leaves, that is, has passed the 2-leaf or seed leaf stage, it is least susceptible when young. In the bud or just before the bud stage it is very susceptible, and susceptibility continues until it is in full bloom. The weeds named are most susceptible when young. Treatment should be applied, therefore, just as soon as most of the weeds have emerged. It should be borne in mind that flax may be in the bud stage when 9 or 10 inches tall. Under unfavourable conditions, such as drought, it may reach this stage, when 6 or 7 inches tall. It will ordinarily be safe to apply the treatment within 2 or 3 weeks after the emergence of the crop.

2. Apply the ester formulations at 2 to 3 ounces acid equivalent per acre, for the susceptible weeds named, and the amine formulations at 3 to 4 ounces. The directions on the container will explain how to obtain these rates of acid equivalent. Remember that the ester formulations are more potent than the amines, and must be applied at lower rates to avoid damage to the crop.

The Cocklebur—a most objectionable weed; a few burs in a ton of flax straw make it worthless for papermaking.

3. Spray is generally more effective than dust. Where dust is used, the rate of acid equivalent should be increased by about 1 ounce.

4. Avoid overlapping between adjacent spray strips.

If one wishes to take further precautions against damage to the crop, one may substitute MCP for 2,4-D. Corresponding rates and formulations have been found to be as effective against weeds as 2,4-D and somewhat less harmful to flax.

When green foxtail is an important weed, as may be the case in late sown

flax, it may be controlled by spraying with the chemical TCA at the rate of 5 to 8 pounds per acre. The application should be made when both the flax and green foxtail are young; 3 inches tall or less. This treatment will not control wild oats.

A good deal of interest is developing in some quarters in the use of the chemical known as DNOSBP for late pre-harvest spraying. The purpose of this treatment is to hasten maturity of the flax and to kill advanced weeds that will interfere with harvesting and combining. It is applied when most of the flax is mature, but later or secondary growth is still on the "green side." It will facilitate straight combining, where it is desirable to use that method of harvesting, or speed up drying in the swath, where the swathing and combining method is used.

Fertilization

Because of the uncertainty surrounding the subject, fertilization was not included among those factors listed in the early part of this paper, as being basic to good production. Results of experiments involving the use of fertilizers for flax have been somewhat erratic. They do not make it possible to offer recommendations that are as definite or specific as in the case of wheat, oats or barley. Excellent responses have been obtained under some conditions. For this reason farmers are urged to make small scale trials on their own farms. They will involve little cost and may prove to be of great value. They may be made in the form of drill strips, or on an area of a few acres within the main field. Since flax is a somewhat heavier user of nitrogen than the cereal crops, one would expect that a 16-20 fertilizer might give greater response than the more commonly used 11-48, although good responses have been obtained from the latter. Rates of 40 to 75 pounds per acre of 16-20 and 30 to 60 pounds of 11-48 are indicated. Summer-fallow is more likely to show response to fertilizer treatment than cropped land. This is so because moisture frequently is not a limiting factor on such land. On stubble land, on the other hand, crops often fail to respond to fertilizer treatment because here, moisture, rather than fertility, is the limiting factor except in the more favourable seasons in the areas of greater rainfall.

Harvesting and threshing

Flax is well adapted to swathing and combining and most of it is handled in this way. It is not difficult to cut when fully ripe. Late sown flax, or varieties too late for the area in which they are grown, will often contain much green growth. This situation should be avoided, if possible, because such flax is tough and difficult to cut. As already suggested, pre-harvest spraying with the new chemical DNOSBP will force maturity of the crop and kill the green growth, thereby overcoming most of the difficulty involved in harvesting it.

Flax should not be threshed until the moisture content is down to 10.5 per cent. The spread between dry and tough or damp flax is often 20 to 30 cents per bushel.

In the event it becomes necessary, because of unfavourable fall weather, as occurred in 1950 and 1951, to thresh the crop before the moisture content is down to 10.5 per cent, and the flax is stored on the farm, it must be watched

very carefully for heating. This is particularly the case when warm weather of spring sets in. If it begins to heat, it must be moved and space provided so that it can be shoveled from time to time as may be required.

Summary

- **Flax is a dependable crop.** When good cultural practices are followed, it will give greater returns than wheat in most years.
- The immediate prospect of attractive price is good.
- **Select clean productive land.** Intertilled crop land, sweet clover or alfalfa land, grass sod or clean summer-fallow are preferred, but much flax is also being grown on second crop stubble land.
- **A well packed seed bed is very important.** Flax must be sown shallow, usually not more than 1 to 1½ inches deep.
- **Sow the crop early.** Ten days after normal wheat sowing time is not too early.
- **Use a rust and wilt resistant variety.** Rocket, Redwood, Sheyenne and Victory are good choices.
- **Control weeds.** The chemical 2,4-D may be used safely if it is applied early and at low rates.
- Green foxtail can be controlled with 5 to 8 pounds per acre of TCA if applied early. Wild oats cannot be controlled with chemicals.
- **Treat the seed with an organic mercury compound.**
- If possible, avoid threshing flax before the moisture content of the grain is down to 10.5 per cent moisture. If it must be threshed and stored at a higher moisture content, watch it very carefully for heating.

THE WIDE VARIETY OF *Flax Products*

EVERY farmer benefits every day from products derived from flax. Most important of these products are the paint, varnish, linoleum and hardsurface floor coverings in which linseed oil is a vital item. But the full list of uses to which flax products are put is much longer.

For example, each year Canadian farmers use many thousands tons of linseed oil meal to fatten livestock. The meal is rich in nourishing protein, and also contains medicinal properties, which other protein concentrates lack. Protection for farm buildings is derived from flax; for every gallon of paint on barns and other outbuildings contains up to two quarts of linseed oil.

Surprising as it may seem, a flax product enters into the making of some of the metal parts of farm machinery. Linseed oil mixed with sand provides the core used in casting parts for tractors, trucks and other farm vehicles and equipment.

The comfort and beauty of the farmer's home owes much to flax derivatives. They enter not only into the making of paint, linoleum, etc., but also into the manufacture of soap, shingle stain, rugs, wallboard, window-blinds and finishes for such improtant household items as refrigerators. Linseed oil is also used in the manufacturing and processing of insulation materials for the radio, telephone and electrical heating and lighting installations.

Printer's inks contain linseed oil. So do automotive brake linings. Gaskets of all kinds, on steam pipes, pumps and motors, are treated with linseed oil, as also is the slicker you put on for a rainy day. Putty, furniture polishes and wood preservatives may also be mentioned as indicating, but not by any means exhausting, the wide scope of everyday items of which linseed oil is an important ingredient.

From ten to twenty thousand tons of flax straw, which previously were burned on the land, are now used annually in the manufacture of many high grade papers, but principally cigarette and banknote papers. This new outlet for a once valueless material means added revenues to the flax grower.

The Canadian Flax Institute

For many years a Flax Improvement Committee has existed in Winnipeg; the membership being producers, processors and users of linseed oil and flax straw. The Committee has consistently endeavored to inform the farmer of the importance of flax and at the same time to give him useful information on the preparation of the land, the correct seed for his district, crop rotation, and other practical phases towards his harvesting and marketing a good flax crop.

The activities of the Committee have now been taken over by the Canadian Flax Institute, which body will perform the same functions, in addition to which the Institute looks forward to the development of scientific studies directed towards the creation of new flax seed varieties and the general improvement of the crop.

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